concrete construction

AUGUST 1958 VOL. 3, NO. 8

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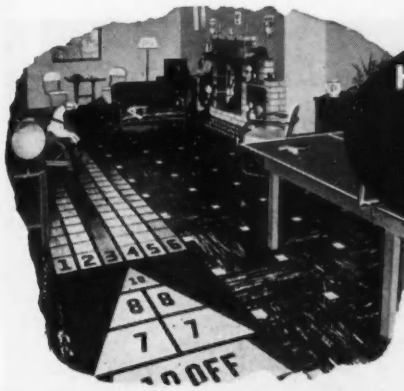
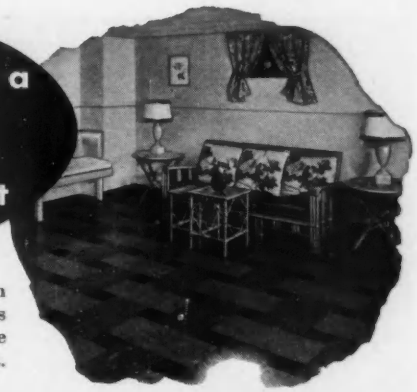


Here's how to build a DRY Concrete Basement



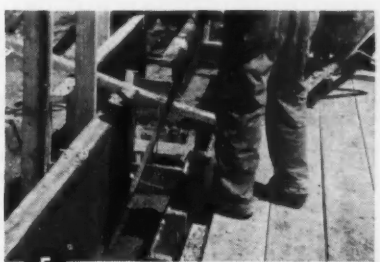
It's easier to build a dry basement than to repair a leaky one afterward. Here's how to build leak-proof, cast-in-place walls to make a dry concrete basement.

1 Place footings on firm soil below the frost line, following building code requirements. If no code is applicable, make them twice as wide and as thick as the wall is to be.

2 If prefabricated forms are used it is important that each panel be carefully cleaned before using. Inside surfaces should be oiled, soaped or lacquered before they are used.

3 Built-in-place forms should be carefully constructed out of sound, knot-free lumber. The forms should then be strongly braced to insure walls that are true to line and grade.

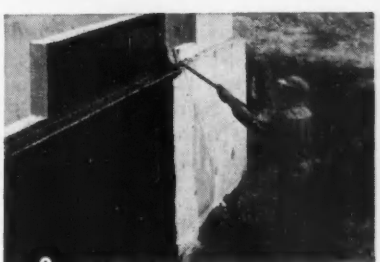
4 Ready mix trucks should deliver concrete at a number of points around the form to avoid chuting over long distances. This prevents segregation—a source of possible leaks.



5 Use a quality concrete mix. Place it in even layers not more than 12 in. deep. Spade or vibrate concrete enough to settle it against the forms and avoid possible honeycombing.

6 Strip forms after concrete hardens sufficiently—usually one or two days in summer, four to seven days in cold weather. Pull out or break off tie rods, patch holes with mortar.

7 Where a smooth surface is desired, remove the fins and other form marks on the surface by rubbing with a carborundum stone and a mixture of portland cement and water.



8 After the basement walls have been completed paint them with two coats of hot bituminous material. The second coat should be applied at right angles to the first one

9 Except in dry climates or in extremely well-drained soils, place drain tile around the outside of the footing. Cover the tile with 12 in. of coarse gravel or crushed stone.

What about condensation? Often builders are blamed for leaky basements when the trouble is condensation. Avoid this by explaining that condensation can be controlled by ventilation, covering cold water pipes or installing a dehumidifying unit.

The big girders were cast adjacent to the bridge site. Note the draped cables over the casting bed at the left.

AIR FORCE ACADEMY BRIDGES SET NEW RECORDS

Another example of how site-cast prestressed concrete can solve railroad and highway bridge design problems.

AMONG THE MANY BRIDGES at the big Air Force Academy project* in Colorado Springs, Colorado, are two that break a couple of American construction records. The record-breakers are a pair of prestressed concrete railroad bridges that will carry the Santa Fe line over the north and the south highway approaches to the Academy. The only other prestressed railroad bridge in this country is a modest 19 feet long; the two new ones have spans of 70 feet. In addition, since the Academy bridges were designed for E-72 loading—heaviest in the books—they also set the record in that department.

A number of highway bridges of 120-foot spans are also being built. Both the highway and the railroad bridges use beams of identical cross-section. The great difference in loading is compensated by the reduced spans, closer beam spacing and increased number of diaphragms used in the railroad bridges.

All the 120-foot highway bridges are being cast on the job site and post-tensioned. This has become accepted as the most economical means of handling large prestressed members. The high transportation cost and increased danger of failure due to improper handling more or less preclude other methods. Then, too, cables can be draped easily and without expensive equipment.

Some pouring practices used on this project are of interest. The tremie, fitted with a rubber nozzle, is passed up and down the length of the forms in pouring concrete for the beams. This has been found superior in several respects to the more common practice of pouring concrete at one end of the form until it heaps to the top and then moving down a bit and repeating the process. The latter method often results in segregation, honey-combing and excessive bleeding.

Deck pouring has been speeded by the use of a novel concrete conveyor. Ready-mix trucks discharge directly into buggies which then ride a monorail out to the particular spot where pouring is taking place. An operator hits a lever on the buggy to stop it when it reaches the desired location.

*See also "Gantries Place Site Cast Prestressed Concrete Girders", CONCRETE CONSTRUCTION, March 1958, page 9.

FILE: PRESTRESS

Two gantry cranes transport one of the 120-foot, 95-ton concrete highway bridge girders from the casting bed to the waiting piers.

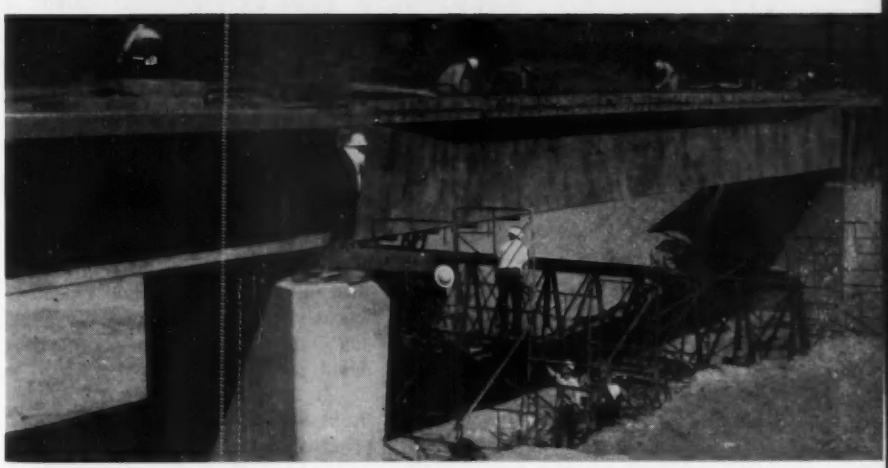
Another lever activates the hopper and the concrete is deposited. The hopper then returns on the circular track to be reloaded.

The pour starts at the far end of the deck. A second rail at the end away from the loading area is positioned while the first is in use. When the pour is completed along the first rail, the buggies are switched to the second, closer rail. Then the first is knocked down and set up closer to the loading area. This is continued until the deck has been completely poured. The track has been found easy and fast to knock down and set up. On a large job such as this, it seems a logical way to get a good, fast pour.

Tests on one of the highway beams and deck sections proved the great strength of the units. Specifications called for a 275-ton load before failure. The test had to be called on account of darkness but at that time loading had reached 325 tons—and the beam still had not failed!

These bridges are more than record breakers. They open a new field to prestressed concrete—railroad bridges. Now that the precedent has been set, many railroad spans that would formerly have gone steel will hereafter be open to prestressed concrete. END

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.



One of the two-span prestressed railroad bridges under construction on the campus of the Air Force Academy.

In this novel setup for handling concrete, ready-mix is simply deposited in self-powered buggies which are sent on their way to the pouring location via a mono-rail.

PIER SLAB SYSTEM

Whether we like it or not, no-basement construction seems to be with us to stay. Here's an economical system for making the slab a true structural element as a means of preventing the settlement and cracking troubles that so often occur with conventional slab-on-ground construction.

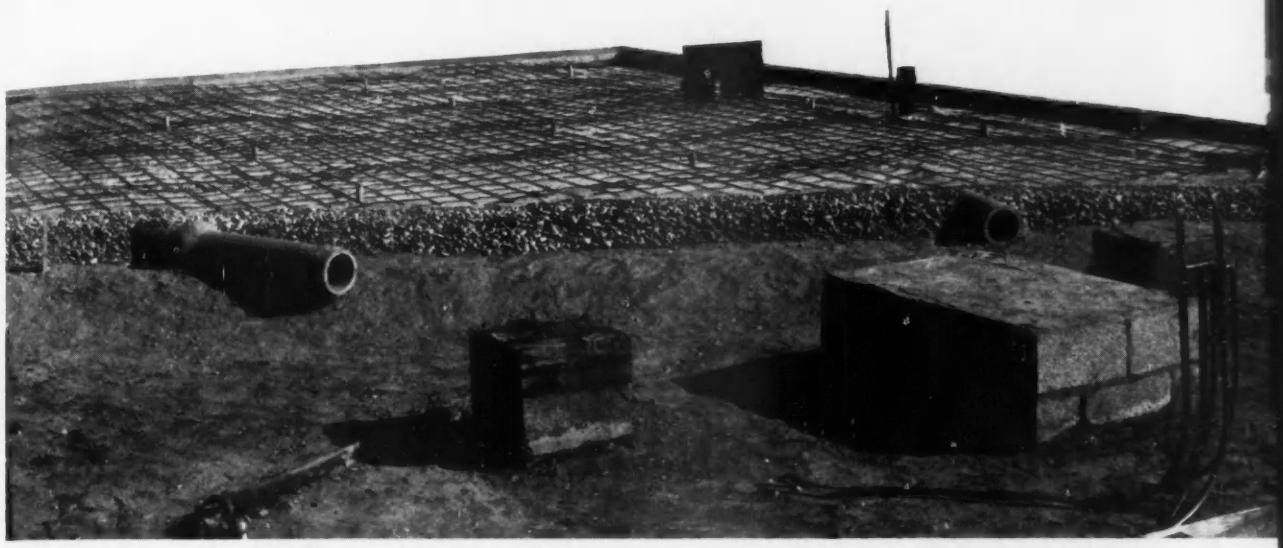
EDWARD R. CARR, big scale Washington area developer, saves $12.50 a house and eliminates slab cracking and settlement problems through the use of a residence foundation design called "intermediate pier floor slab construction." The new ground slab design has been required by FHA's District of Columbia office for approximately the past 5 years, with nearly 5,000 installations to date, many of them by Carr.

The important difference between the new floor design and conventional slab-on-ground construction is that the concrete floor, in combination with welded wire fabric reinforcement, is a semi-structural slab somewhat similar to a bridge deck. The weight of the slab and its residential load actually is borne by the foundation walls and the intermediate supporting piers which penetrate to undisturbed soil. In contrast the conventional slab-on-ground is floating and in theory is supported entirely by the soil upon which it is poured.

Because the backfill's principal function in the pier slab system is temporary—to serve as a form for the concrete until it sets—almost any material available, except organic or vegetable matter, can be used. Conventional construction, of course, requires select backfill, free of vegetable matter, thoroughly tamped and compacted in the hope of providing firm support for the life of the slab. Experience indicates that this hope is often unfulfilled.

With intermediate pier slab construction owner complaints caused by settling and cracking of ground floor slabs appear to be a thing of the past. During the two years of Carr's use of the FHA required floor system, B & B Construction Company (a Carr affiliate) has not had to go back to repair any faulty slabs. Conventional floating slabs, however, have been a persistent source of trouble. Many builders have been required to rebuild floors which settled and cracked due to the unstable soil of the Washington area.

The first construction step, after determining the floor level of the house, is to run up footing walls in the usual manner, and build piers to the same height of solid concrete block on 6- to 8-foot centers in each direction of the floor plan. The piers shown in the photographs are 16 inches square.



Cross sectional view of intermediate pier slab system in use. From top to bottom: welded wire fabric, polyethylene vapor barrier, 6 inches of gravel and uncompacted backfill. Each of the two 16-inch square piers showing is matched by two more in line under the vapor barrier and fabric. These six piers, which rest in undisturbed soil, and the edge foundation walls (not the soil underneath) will support the 4-inch thick slab to be poured. The reinforcing fabric enables the concrete slab to act as a semi-structure, transmits the live and dead loads of the slab to the edges and to the piers. The large, rectangular concrete block structure between piers is base for furnace, to which transite ducts projecting out of cross section will extend for distribution of heat.

They are built up by courses of 8- by 8- by 16-inch block, with the bottom course bearing and fully settled in undisturbed soil, on a poured 4-inch thick concrete footing (not an FHA requirement). The piers may be capped off with concrete to bring them up to the exact level of the underside of the floor slab. The piers can also be built of poured concrete, using round fibre tubes as forms.

Next operation is backfilling, using available material, to within 6 inches of the tops of the piers. Transite heating ducts are then placed, leading off from the furnace base which has been previously poured, and plumbing is roughed in.

Over the non-compacted backfill goes 6 inches of washed, number 6 gravel to help carry off any possible ground water. A vapor barrier is placed over the gravel and then welded wire fabric reinforcement, 6 by 6-6/6, is placed. As a precaution against having the transite heating ducts subside into the backfill, hanger straps around them are secured to the fabric.

The final operation, of course, is placing the ready mixed concrete. Here care is taken to be sure that the welded wire fabric is properly positioned in the 4-inch thick slab, about one inch from the bottom. Experienced workers position the fabric by rocking it up into place with the tip of a pickaxe as the pour progresses. This is of vital importance because the slab is a structure in the engineering sense of the word. The reinforcement must be near the bottom of the slab to lend tensile strength in the area of greatest deflection, or bending, and transfer the weight of the slab to the footings and the piers.

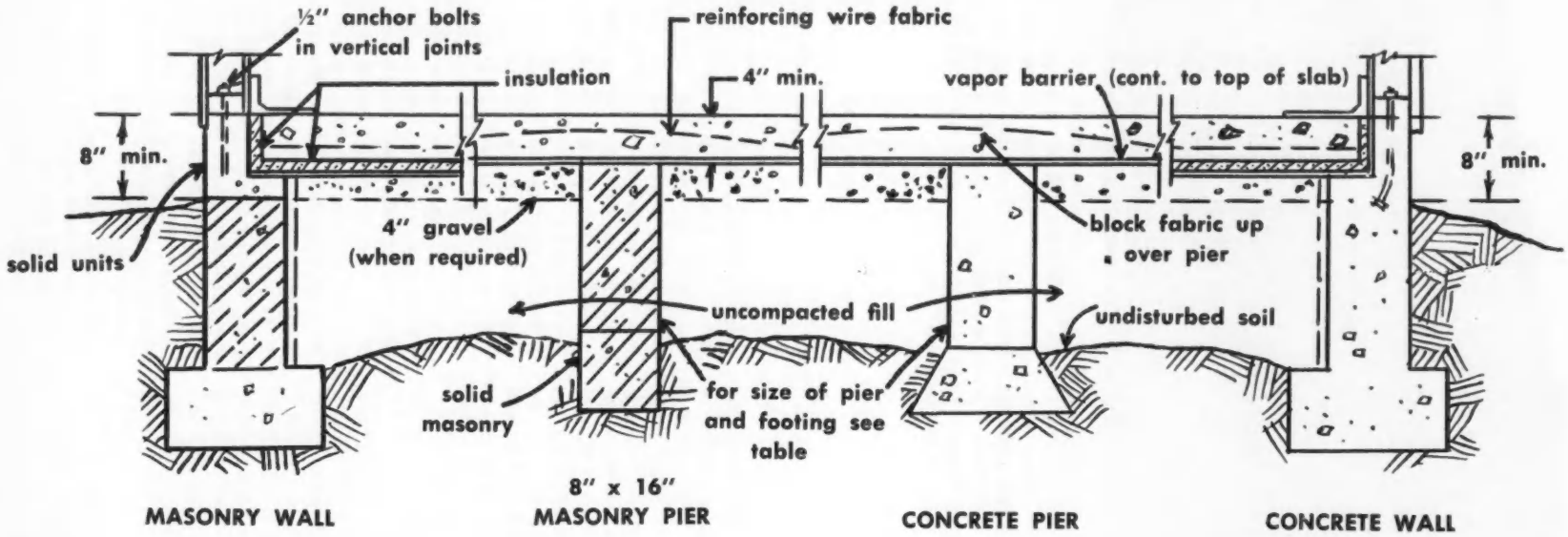
One of the problems which the new design has helped solve is that of maintaining a thermal and vapor barrier under the slab. It had been found that although "mud-jacking" might correct settling of a conventional floating slab, it often destroyed the vapor barrier in the process, and by replacing the select sub-soil with mud, broke down any semblance of a thermal barrier and made the slab cold.

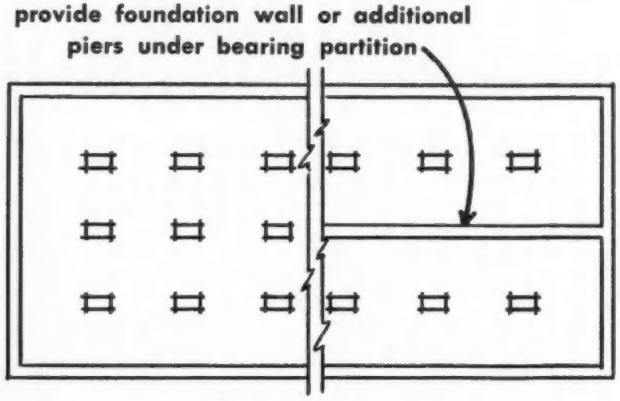
In a pier-supported slab, as contrasted with a ground-supported slab, the uncompacted fill under the slab acts only as a form for the concrete. The reasoning is that after the concrete sets, subsidence and natural compaction of the loose fill will take place, and actually open up a sealed air space between the fill and the underside of the slab. Because the sealed air is an insulator, the resulting slab is materially warmer and dryer than one in intimate contact with the sub-soil.

Houses built with the intermediate pier slab system, often known as Simpson piers (after Edward L. Simpson, chief architect for FHA's District of Columbia insuring office), most often use a trussed roof system, since the slab alone will not carry load bearing partitions. Where bearing partitions are desired, a foundation wall must be built or a ground beam be incorporated into the slab. FHA plans to include tables of reinforcing steel for edge and pier (or intermediate wall) supported slabs in the new Minimum Property Standards, so that builders throughout the country can take advantage of this improved method of construction.

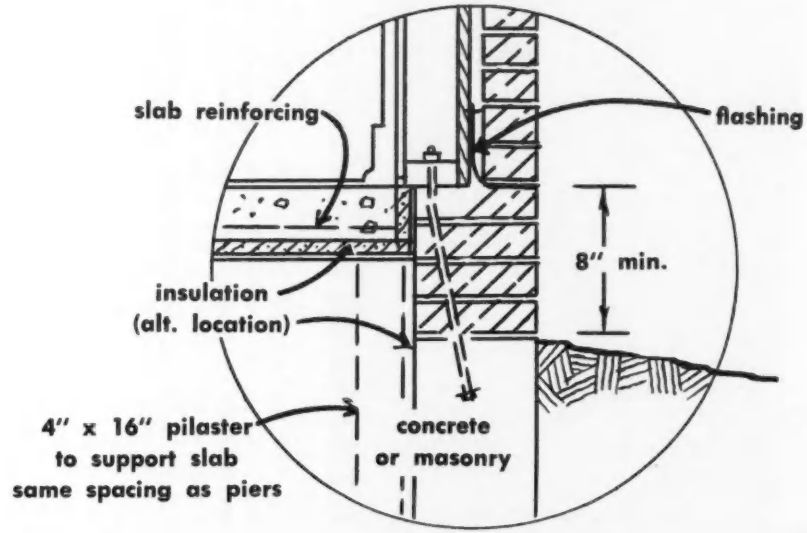
FHA spokesmen point out that the pier slab method requires little or no more welded wire reinforcement than most good builders provide for shrinkage and temperature steel in floating

Concrete Slab with Edge and Intermediate Pier Supports





SCHEMATIC PLAN
see table for maximum pier spacing and slab reinforcing



VENEER WALL

Thomas A. Cary (right), vice-president and project engineer for B & B Construction Company, and supervisor Andrew Prince inspect top of 16-inch square intermediate pier (outlined by white dashes) which is just below vapor barrier. Weight of 4-inch thick concrete floor slab which will be poured is borne by this pier and five others, plus edge foundation walls. Pier system eliminates need for expensive compaction of backfill beneath the slab. Welded wire fabric reinforcement adds tensile strength to the slab, enables it to act as a semi-structure. Note how fabric is overlapped (foreground) and fastened by clipping and bending back wire.

Minimum Reinforcing for 4 inch thick Ground Supported Slabs with Additional Edge and Intermediate Pier Supports

Length of Slab	Maximum Spacing Center to Center of Piers		
	6 Ft. Minimum Pier Footing 115 Sq. In.	7 Ft. Minimum Pier Footing 130 Sq. In.	8 Ft. Minimum Pier Footing 175 Sq. In.
Up to 45 Ft	6 x 6 – 10/10	6 x 6 – 8/8	6 x 6 – 6/6
Over 45 Ft Up to 60 Ft	6 x 6 – 8/8	6 x 6 – 8/8	6 x 6 – 6/6
Over 60 Ft Up to 75 Ft	6 x 6 – 6/6	6 x 6 – 6/6	6 x 6 – 6/6

(Above reproduced with permission from FHA *Minimum Property Standards* for *Properties of One & Two Living Units*, Chapter IX, page 202 (Third Draft, May 10, 1957)

type slabs. The reason for this is that although the pier slab is designed to support live and dead loads in accordance with recognized engineering practice, a lower factor of safety than that required by the ACI Building Code may be used.

Because the slab would be supported by the ground in case of a failure, allowable working stress for reinforcing steel has been increased to not more than 40,000 psi for this type of slab. This value, FHA points out, is well below the welded wire fabric's minimum yield of 56,000 psi.

Edge and pier (or intermediate wall) supported slab-on-ground floors should be limited to those sites where fill can be compacted to eliminate all but minor settlement, FHA cautions. (Machine compaction, however, is not necessary). In general, fill should not exceed about 3 feet of earth, or 6 feet of sand, gravel or other easily compacted granular material.

The pier slab, or edge and pier system, is being studied by ACI's Committee 332—"Recommended Practice for Residential Concrete Work."

END

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Here are some basic things

every builder should know about . . .

SOIL AND SOIL MECHANICS*

SOIL IS THE MOST COMMON of all materials encountered in construction operations. Probably because it is so common a material, it usually does not receive the attention it deserves. It is often neglected until it causes trouble. In many cases when difficulties occur, damage has been done which cannot easily be remedied. Soil provides the foundation bed upon which most structures are built; it has to be excavated in large quantities; and it supports not only the pavements of air fields but the pavements of all roads and highways. Soil is therefore not only the most common material encountered in building but probably the most important. It must be regarded not merely as "mud" but as a vitally important building material.

It is now possible to study soil and to design with it in the same way as has been the practice with other building materials such as steel, wood, and concrete. Unlike these materials, however, soil cannot be made specially to suit a particular job. It is possible, however, to take samples of soil and to study its properties both in the laboratory and in the field by means of very simple tests and in this way to guard against possible difficulties.

It is the purpose of this article to explain what soil is, how it can be studied, and what simple practical measures can be taken to avoid trouble in building operations. While the discussion is not in any sense a manual of soil mechanics, it is hoped that it will make clear that soil is a material that can be controlled and used with success if certain simple precautions are taken. At the end of the article is a list of publications to which the interested reader may refer if he wishes to know more about soil.

WHAT SOIL IS

The word *soil* is used by engineers and builders to describe all the loose material in the crust of the earth. Soil is, therefore, a word which is used to describe many different types of materials found in nature. All of these materials consist of fragments of various sizes which together form a part of the solid ground. The first and one of the most important things to know about soil is that it is not a solid material in the same way as are wood or steel or concrete. Some clays may look as though they are solid but, when they are examined carefully, it will be found that they are made up of tiny particles which can be separated from one another.

Accordingly, when we talk of soil we are talking of a material that is made up of a lot of small solid particles fitted together. In between the particles there will be spaces, called voids. In a dry soil these spaces will be filled with air; in a wet soil the spaces will be filled with water. For the most part, however, the voids in soils will be filled with both air and water. This sort of material is called a three-phase system. This term is a convenient way of drawing attention to the fact that all soils include the three materials—air, water, and solid soil particles—in varying proportions.

Occasionally there may be other materials found in soil, but they are not as important as the three already mentioned. For example, there are soils which sometimes contain black material which is obviously derived from vegetation. This is called organic material; such soils are called organic soils. Normally organic material occurs only in the topsoil but sometimes it may be present at great depths.

GEOLOGY AND SOIL

If the small particles that make up the bulk of all soils are examined, by eye or with a magnifying glass, it will be seen that they are small fragments of rock-like materials. This is so because all soils have been formed by the disintegration of different kinds of solid rocks. A familiar example is the ease with which sand grains can be rubbed off solid sandstone. Other sorts of rocks will flake when exposed to the rigors of cold climates. Rocks that have been worn smooth can be seen in many river beds. These are just some of the results of natural processes which, when combined, are called rock weathering. Soils consist of the products of rock weathering.

In some of the warmer parts of the world, it is possible to see the disintegration of rock actually taking place, the particles remaining in place over the rock surface which is disintegrating and forming residual soils. In the colder climates soils have generally been formed by the grinding of solid rock by the ice which once covered the land. These particles have been carried from their original position, first by ice, and then in many cases by water. All such soils are called transported soils. (MORE)

*An authorized reprinting of one of a series of bulletins on better building practice issued by the Division of Building Research, National Research Council, Ottawa, Canada.

The way in which soil particles have been transported from the parent rock will affect their properties. Some particles have been changed very little since being ground off the rock surface by the ice. Others have been through many processes before being deposited as sediments in lakes and rivers. The geological history of soil particles will therefore have a great influence upon the properties of the soil which they form.

SOIL TYPES

Soils vary all the way from coarse mixtures of sand and gravel to fine-grained clays with the consistency of soft butter. Different classes of soils have been generally recognized. There is agreement about the main characteristics of soils that can be used in describing the different types.

The major division is between coarse-grained soils and fine-grained soils. Coarse-grained soils are those which are made up of particles which are clearly visible to the naked eye. Similarly, fine-grained soils consist of particles which cannot be distinguished by the naked eye. The term organic soil is not really another division but is used to describe any soil which contains a large proportion of organic matter.

These divisions provide a simple guide to the description of soils. However, there are many soils that contain both coarse and fine particles. These soil mixtures are always due to glacial action and can easily be recognized as a special soil group.

Before soils can be handled with confidence, the type of soil involved must be recognized. The first step in dealing with any soil is to be able to describe it accurately. To do this, it is necessary to have a good look at it! This merely means getting a handful of soil and studying it carefully, first with the naked eye. With coarse-grained soils it is important to notice the shape and size distribution of the particles. If there is a fairly even distribution of grain sizes, the soil is termed well graded. If most of the particles appear to be of one particular size, the soil is poorly graded. If it is impossible to see the individual particles with the naked eye, or even with a small magnifying glass, then other methods must be used for identifying which type of fine-grained soil is involved.

The accompanying table shows how some major types of soil can be distinguished from one another. It provides

FIELD DESCRIPTION OF SOILS

Major Divisions	Sub-divisions	Field Identification	Information for Description
COARSE-GRAINED SOILS	Gravel	Smaller than 3 inch but larger than ¼ inch.	Grading, Density, Particle Shape, Stratification
	Sand	Smaller than ¼ inch but large enough to be visible to the naked eye.	Grading, Density, Particle Shape, Stratification, Organic Matter
FINE-GRAINED SOILS	Silt	Powders easily when dry, only slight dry strength. Gritty to the teeth. Dries rapidly. Reacts to the shaking test. No shine imparted when moist and stroked with a knife blade.	**Consistency:** undisturbed —remoulded, Plasticity, Dry Strength, Structure
	Clay	Possesses appreciable dry strength. When moist, sticks to fingers and does not wash off readily. Not gritty to the teeth. No reaction to the shaking test. When moist, shiny surface is imparted when stroked with knife blade.	**Consistency:** undisturbed —remoulded, Plasticity, Dry Strength, Structure
SOIL MIXTURE	Glacial Till	Extreme range of grain sizes from large boulders to the finest clays.	Density, Grading, Plasticity

a guide to the proper field description of soil. The following notes supplement the table and will assist in identifying the different types of soil.

Sand and Gravel—Sand and gravel are the easiest types of soil to distinguish since they are so familiar. They consist of coarse particles which may range in size from about 3 inches in diameter down to small sand grains which can just be distinguished with the unaided eye as separate grains. The most important property to watch for is whether the mixture of particles is well graded or not.

Silts—The word silt is used to describe a third group of soils in between the two main groups, sand and clay. This group, which is of great importance in Canada, consists of soils that are made up of particles which are just finer than the finest sand particles, and yet are not as small as the microscopic particles that constitute clays. Since soil particles in silts cannot be seen, we need not trouble about their actual size as silts can be recognized by other characteristics. Essentially silts consist of particles of fresh-ground rock which have not had time to change their character into the minerals which make up clays. They therefore exhibit special properties which can easily be recognized when water is present, as it practically always is where silts occur.

Clays—Clays are the soils which are made up of the finest possible particles, particles which cannot possibly be seen by the eye or even with ordinary magnifying glasses. All of the particles, for example, will usually be smaller than 1/10,000 of an inch in diameter. In addition to the effects of particle size the special properties of clays are caused by the presence of "clay minerals." These minerals result from changes in the bed-rock material, changes which took place through different kinds of natural weathering. It is the combination of these clay minerals with water which gives to clays their very special properties—the stickiness of prairie gumbo, for example.

How to distinguish silt from clay—Because silts and clays look so much alike, it is useful to know the tests by which they can be distinguished. There are three simple ways of doing this.

The first is called the shaking test. If a pat of the wet soil is shaken vigorously in the hand, the surface will become glossy and will shed the free water. If the pat of soil is then squeezed in the fingers the free water may disappear, in which case the soil is a silt. If the free water does not disappear then the soil is probably a clay.

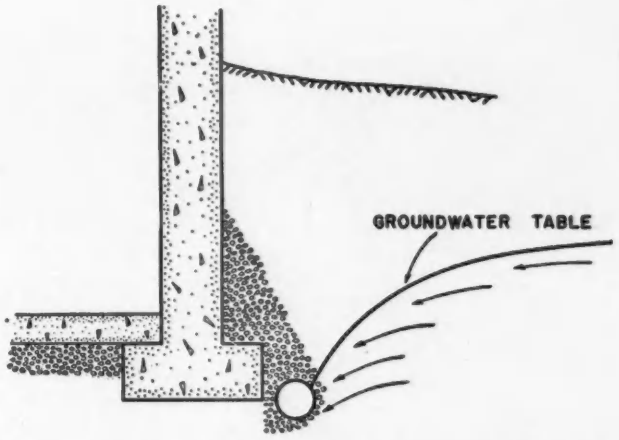


FIGURE 1. Whenever investigation reveals that the groundwater is likely to be at a higher level than the floor of a building or basement, drainage pipes should be installed close to the foundation walls to carry excess water away. Similar precautions should be taken in connection with excavations.

The second test is called the shine test. If a moist lump of soil is stroked with considerable pressure either with the flat of a knife blade or with the finger nail the soil can be recognized as a silt if a dull surface is produced, and as a clay if the surface is shiny.

The third simple test is the dry strength test. If a small piece of soil is broken after it has been dried, its breaking strength is some indication of its character. If it is very strong it is almost certainly a clay, but if it powders easily, then it is probably a silt.

In addition to these tests, clay sticks to the fingers when wet and it does not wash off easily. Silt, on the other hand, will wash away easily or will brush off when dry. When a small quantity of soil is placed between the teeth, the presence of grit will indicate silt or sand but if no grit can be detected with the teeth, then the soil is certainly a clay.

Glacial till—This is a very common type of soil in some areas. The name is given to the mixture of all sizes of soil particles which results from the movement of glaciers over solid rock without any subsequent sorting of the material. Glacial till is usually a very hard and compact soil containing boulders, gravel, sand, silt and clay-sized particles. It is often so hard that it is sometimes called hardpan but this is a misleading word and should never be used. If such material is dried and a lump is placed in a glass of water, it will probably disintegrate almost immediately, showing how deceptive its apparent strength can be.

Fill—Special care must be taken in all studies of soil to guard against mistaking fill for natural soil. In many city areas, depressions have been filled up with rubbish and soil excavated from other areas. Unless such dumped material has been very carefully compacted, it may be in a very loose state and therefore not a suitable soil for building upon. It can usually be identified by its loose condition and by the presence in it of other material such as twigs, grass, rubbish, etc.

GROUNDWATER

Beneath the surface of the ground in most parts of the world water will be found at varying depths. Everyone will be familiar with the water that is found standing in wells. Many will be familiar with springs which demonstrate so clearly the existence of water in the soil making up hillsides. The water held in the ground is called groundwater. It comes from rain falling on the surface of the ground and then seeping down to the point at which it meets the mass of water already there. It is this groundwater which feeds streams and rivers during dry periods.

The influence of groundwater must be considered in relation to soil studies whenever excavation is going to penetrate much below the surface of the ground. If groundwater is present at a site that is to be excavated, it can cause untold difficulties if it is not dis-

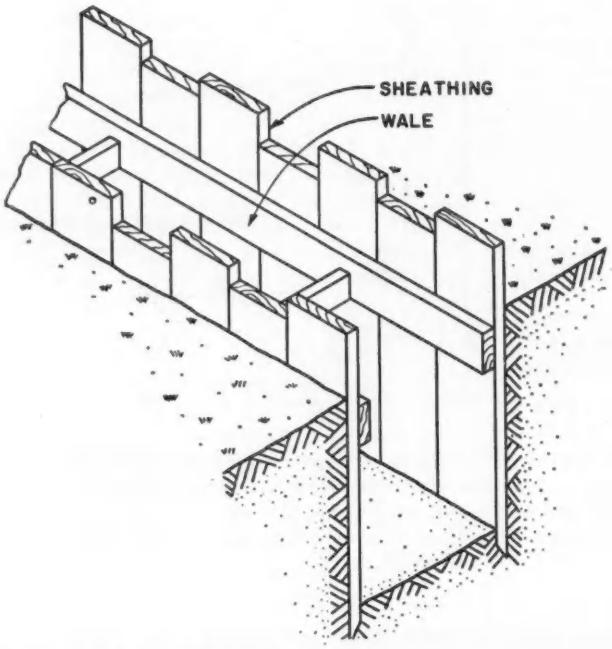


FIGURE 2. Simple shoring, consisting of vertical sheathing and horizontal wales separated by wedged braces, should be used as a safety measure for all deep trench excavations in fine-grained soils.

covered before work begins. Groundwater levels can be easily established by observing the water levels in bore holes at the site. These levels will be found to vary depending on climate conditions. They will usually rise after rain and fall during dry periods. In general, the highest level of groundwater can be expected in the spring just after the snow has melted; it will probably be at its lowest at the end of the summer.

Groundwater moves through the voids between soil particles. It will therefore be easy for it to flow in sands and gravels but difficult for it to flow in fine-grained soils. Accordingly, groundwater level changes will take place quickly in sands but may be very slow in silts and clays.

DRAINAGE

Drainage consists of providing the means for removing surface water that is not wanted and also for removing groundwater which is going to interfere with building work. The handling of surface water is a relatively easy matter, since it can be seen. Groundwater can be removed in the same way as surface water—by letting it run downhill to some suitable outlet.

In arranging for subsurface drainage the first thing that must be known is the highest level which the groundwater is likely to reach. This is found by observing groundwater levels at the building site for as long a period as possible. When the maximum possible level of ground water is known, it is compared to the bottom level of the excavation to establish the level below which this water must be drained. Some means must then be found for connecting the excavation to an outlet which is lower than its bottom level. Drainage pipes must be installed accordingly.

It is this principle which is applied in the laying out of drainage pipes around a building foundation to keep water away from the walls of the building. How this can be done is shown in Figure 1.

It is good practice, in very wet impermeable soils (such as clays) to provide a substantial backfill of permeable material (for example gravel or sand) around drainage pipe and under basement floors. To reduce infiltration from above, the permeable layer should not extend to the surface. Correspondingly, the surface should be sloped away from the building.

EXCAVATION

Excavating soil is usually regarded as such a simple and straightforward operation that all too often no preliminary study of the soil is made. Before any excavation is carried out, some attempt should always be made to find out what type of soil is to be removed, and whether the groundwater level is below the bottom level to which excavation is to be carried. If it is not below this level then arrangements must be made before excavation starts for the necessary drainage of the area.

If the excavation is to be in sand and gravel, there is really only one problem and this is the slope that will be taken up by the sides of the excavation. With such coarse-grained soils, the particles of soil will come naturally to rest at a stable slope at an angle to the horizontal which is called the angel of repose. For ordinary sand and gravel this is never less than 30 degrees (1:2). Knowing this, the principal lines for the finished excavation can be laid out.

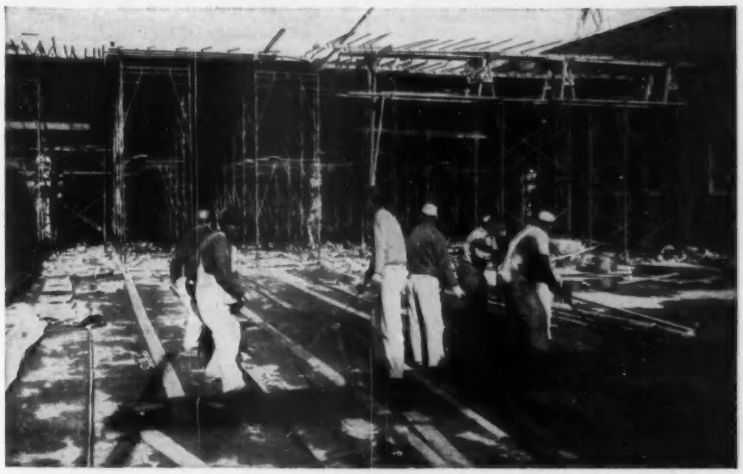
The real troubles that arise in excavation are almost always with silts and clays. If these materials are damp when excavated, as they usually will be, they will stand up on almost vertical faces without support. Such newly cut faces in fine-grained soils appear to be safe and yet can be unstable. In many cases, the stability is not real and a sudden failure may occur without much warning. In most cases of serious failure, a large section of the bank will slide into the excavation. It is, therefore, unwise and often dangerous to load the bank by placing the excavated material next to the cut face.

In all excavation in fine-grained soils, the effect of time must be remembered. In the first place, the soils will gradually dry out. As they dry many soils (particularly silts) will lose strength immediately. An old construction practice which is still useful is to cover such exposed faces with tarpaulins immediately, to keep them damp. This, however, should be done only in the case of excavations that are to stand for a short time only. For all deep trench excavations in fine-grained soils, no such risk should be taken. Shoring should be installed as soon as possible to avoid any possibility of sudden failure. Construction safety rules which include directions for the shoring of excavated trenches must *always* be followed. Simple shoring consisting of vertical sheathing and horizontal wales separated by wedged braces shown in Figure 2.

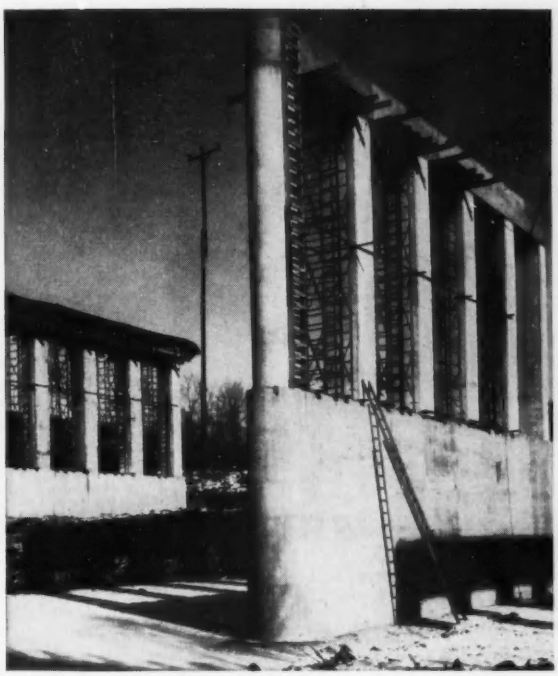
This two-part article will be concluded in the September issue.

Shoring Methods...

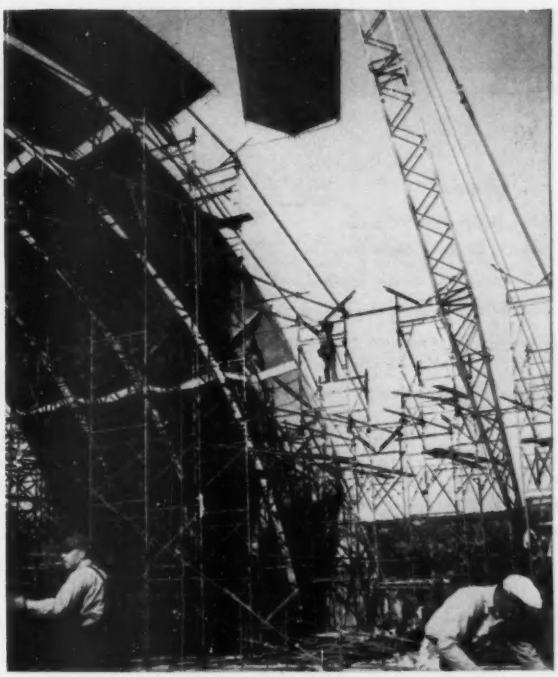
A Picture Report on Efficient Ways to Shore Concrete . . . by Patent Scaffolding Co.



FAST METHOD MOVES SHORING WITH FORMS—Soaped sills, placed under shoring legs, provide fast movement of 960 sq. ft. sections of "Trouble Saver" Shoring with formwork, to succeeding drophead panels on this slab job at Kentile, Inc., So. Plainfield, N.J. Method uses only half the shoring (462 frames) and formwork usually required, and saves the contractor, Fred J. Brotherton, Inc., considerable time, equipment and costs. Each section is moved, as shown, to its new location in just 15 minutes.



EASY-TO-ERECT PIER SHORING—"Trouble Saver"® Steel Shoring, made with 3'-wide ladder frames, provides ample support for beams on several pier capitols on this bridge in Palmyra Township, Pa. Frames, spaced 3' apart, shore capitols 3'6"-wide by 4'-thick. Built-in ladders give workers quick access for forming and stripping. Willis, Paul & Proctor, general contractor. P.S. Co. offers engineering layouts specifically detailed for every job.



CORRUGATED BARREL ROOF SUPPORT—Support for this unusual corrugated, reinforced concrete roof is provided by "Trouble Saver" Shoring towers with 104 special V-shaped cradle frames. These units, designed by P.S. Co., were set on top of the shoring frames to conform to roof segments, which measure 10' 3½" wide and 2'9" deep in cross section. Holy Trinity H. S., Trinidad, Colo. Platt-Rogers Constr. Co., gen. contr.

Complete scaffolding equipment and engineering service offered through nation-wide sales offices or representatives. Look under Patent Scaffolding in the Yellow Pages for your nearest source.

SALES **RENTALS**

FOR GREATER SAFETY...EFFICIENCY...ECONOMY

GOLD MEDAL LADDERS SCAFFOLDING

THE PATENT SCAFFOLDING CO., Inc.

38-21 12th Street, Dept. CCM, Long Island City 1, N. Y.

1550 Dayton Street, Chicago 22, Illinois • West Coast: 6931 Stanford Ave., Los Angeles 1, Calif.

In Canada: 355 Dufferin St., Toronto • *Branches in all Principal Cities*

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WORLD'S LONGEST SUSPENSION BRIDGE

Better Control of Lightweight Concrete Workability and Shrinkage with POZZOLITH*

Mackinac Bridge, Michigan
Owner: Mackinac Bridge Authority
Consulting Engineer: Dr. D. B. Steinman
Associate Consultant: Glenn B. Woodruff
Substructure Contractor: Merritt-Chapman & Scott Corp.
Superstructure Contractor: American Bridge Div. U. S. Steel Corp.
POZZOLITH Ready-Mixed Concrete: Louis Geravaglia Co.

***Below:* Determining Workability with Kelly Ball — observing penetration into fresh concrete.**

Workable, lightweight concrete, with 2½"-3" slump . . .
Good cohesiveness and reduced shrinkage . . .
Strength: 4250 psi average at 28 days — 3000 psi specified . . .
. . . these are several of the benefits obtained with POZZOLITH in the lightweight concrete filled floor sections of this $100-million structure.
One of our fieldmen will be glad to demonstrate — at your desk or on the job — the important advantages of POZZOLITH for *your* projects.

***POZZOLITH — Master Builders trademark for its time-tested water-reducing, air-entraining admixture for concrete.**

THE MASTER BUILDERS CO.
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General Offices: Cleveland 3, Ohio • Toronto 9, Ontario • *Export:* New York 17, N. Y.
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For letter-perfect concrete

Certainly you can make concrete *without* WRDA and DAREX AEA. But since something of your professional reputation gets poured into every yard you produce, WRDA *and* AEA provide very inexpensive insurance that your good name never will grow less.

Add air to the mix with DAREX AEA and millions of lubricating air bubbles become permanently imbedded in the finished concrete. Controlled air makes the concrete frost-resistant and a whale of a lot more durable. DAREX AEA introduces and controls it.

Reduce water with WRDA and you get a fatter, more uniform mix, with cement particles evenly dispersed and catalyzed throughout. Don't be at all surprised to find compressive strength going up as much as *25 per cent*. WRDA makes concrete pour better too.

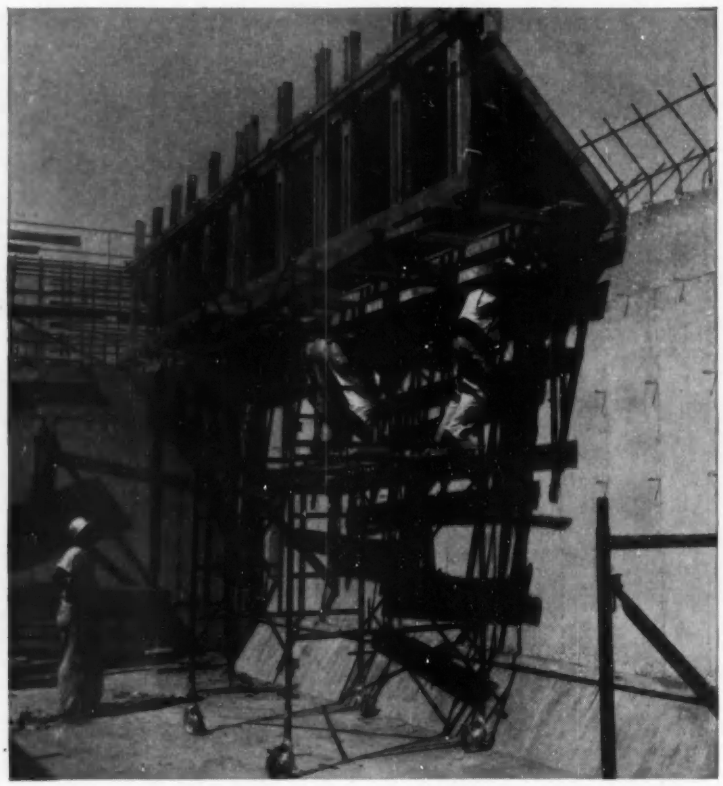
Take our words for it: WRDA and DAREX AEA. Together they mean letter-perfect concrete.

DEWEY AND ALMY
CHEMICAL COMPANY
DIVISION OF W. R. GRACE & CO.
Cambridge 40, Massachusetts
San Leandro, Calif. • Montreal 32, Canada

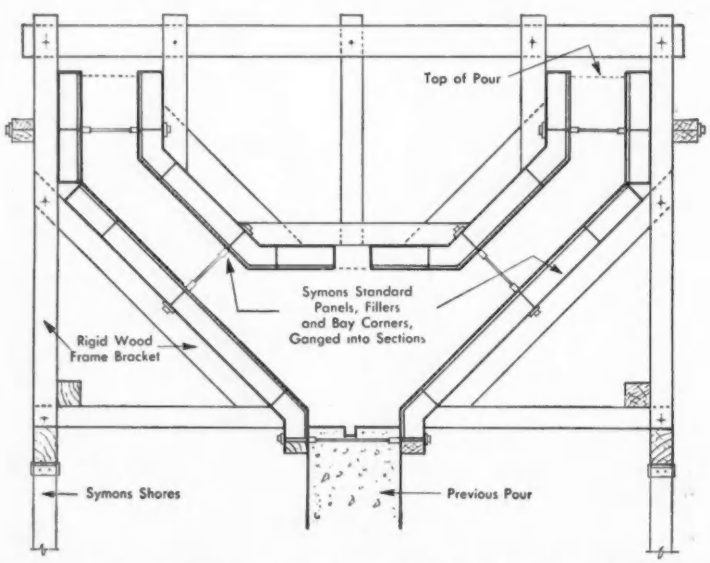
WRDA

DAREX AEA

Gang Forming Licks "Y" Wall Problem



Workmen on Columbus sewage extension job are putting a gang forming section into place for a pour with aid of rolling scaffolding. Ganged section was 16 feet long.



Typical "Y" wall section in which Symons standard panels, fillers, inside and outside bay corners, which were eight feet long, were ganged in 16 foot sections.

Pays Off in Quality Pours, Speed and Reduced Costs

2,665 lineal feet of "Y" walls and half "Y" walls, with 16'9" high walls on a tank addition to a sewage treatment plant—that was the pouring problem faced by contractors, Wander & Mason of Worthington, Ohio.

They solved the problem by pouring the walls in three lifts with the forms ganged for the final "Y" and half "Y" pours. The tank was 485 feet long and 120 feet wide with five 485 foot "Y" walls in the tank.

On the "Y" walls Symons standard panels, fillers, inside and outside bay corners, which were eight feet long, were ganged in 16 foot sections and handled either by crane or rolling scaffolding. Ganging the forms licked the problem. Quality of the pour was excellent. Speed of erecting and stripping reduced cost appreciably. One 16-foot outside section was stripped, moved to the next wall section and reset by three men in 20 minutes.

Rigid frames to brace the ganged forms were designed by Symons engineers and representative Rapid Construction Equipment, Inc., and built on the job site by the contractor. The outside "Y" wall form section was held to the previous pour by anchor bolts and supported by Symons Shores spaced four feet on center at the outer extremities of the bracket. Additional shores were used beneath the bracket to supplement the anchor bolts near the main wall.

Inside forms were completely ganged and before pouring were bolted to the outer vertical members of the outside frame. This method held the inside forms in position along with the assistance of the coil ties which were spaced on four foot centers. This prevented the inside from floating while pouring.

Symons Forms, Shores and Column Clamps can be rented with purchase option. Information on Symons products available upon request.

Symons

SYMONS CLAMP & MFG. CO.
4271 Diversey Avenue, Dept. H-8
Chicago 39, Illinois

Warehouses located in California, Kansas, Minnesota, New Jersey, Oregon.

Sales Offices and agents in principal cities.

MORE **SAVINGS** FROM **SYMONS**

Circle #521 on mailing card

Using light hammer blows to force extruded lead strip into concrete joint until slightly above floor level.

LEAD JOINTS...

They may be the solution to contraction joints that chip under heavy industrial traffic.

ONE OF THIS MAGAZINE'S READERS recently requested information on joint filler materials for heavy industrial floors, stipulating that ordinary materials had already proved unsatisfactory for the application in question due to excessive chipping in the joint area. One solution to this not uncommon problem is to use lead to fill the joints in areas where heavy traffic is anticipated. Joints filled in this fashion have less tendency to chip under heavy wheeled traffic because the lead gives considerably more support to the edges of the concrete than can be expected of an ordinary mastic material.

We are indebted to the Lead Industries Association for the following information concerning the technique used in filling more than 1,200 feet of contraction joints in the floors of an eastern factory. In this project the tooled joints in the concrete were made to accommodate ¼-inch thick by 1-inch deep extruded lead strips. The tooled joints were made slightly less than 1 inch deep to allow 1/16 to ⅛ inch of lead to project above the surface. This excess material was carefully hammered down to the approximate level of the floor after the lead strips had been placed in the joints.

This technique is said to be more satisfactory than the old-fashioned method of filling the joints with molten lead, which necessarily involved danger of spalling because of the considerable amount of heat brought in contact with the concrete. The use of molten lead also makes it essential that the joint be free of moisture at the time it is filled, whereas there is no such requirement with the extruded lead strips.

On the project in question the hammered lead did not always completely fill the joint because of occasional irregularities in the concrete. Imperfectly filled areas were readily taken care of after the hammering was completed by introducing additional material by means of the lead burning technique.

What about the possibility of reaction between the lead and the concrete? Lead does undergo some corrosion when it comes in contact with green, wet concrete. For this reason it seems advisable not to fill contraction joints with lead until the concrete has cured thoroughly. END

Lead burner adds molten lead to joint where required.

questions and answers

QUESTION: What kind of masonry water-repellent coating was used for the roof surface of the folded slab structure described on page 8 of your May (1958) issue?

ANSWER: The product used was Hallecrete, manufactured by the Hallemite Manufacturing Company of Cleveland. Three coats of the material were used at an approximate cost of 9 cents per square foot in place. The joints in the valleys of the folded slab sections were flashed and treated with masonry caulking before the repellent coating was applied. It is believed that this treatment will render the concrete surface waterproof for a period of nine or ten years.

QUESTION: Is it possible to determine the water–cement ratio used in mixing concrete from the examination of samples of hardened concrete?

ANSWER: Yes, this can be done with reasonable accuracy through a somewhat involved chemical analysis. The method is described in the October 1957 issue of Journal of Applied Chemistry, a British publication.

QUESTION: What is the difference between natural cement and portland cement?

ANSWER: The difference lies mainly in the process of manufacturing. Portland cement, which accounts for almost all of the cement used in construction work, is made with an artificial mixture of limestone and clay burned at very high temperatures. The so-called natural cements are produced by calcining natural rock at considerably lower temperatures than those required in the making of portland cement.

QUESTION: Who supports the Cement Reference Laboratory and where is it located?

ANSWER: The Cement Reference Laboratory operates from headquarters located at the National Bureau of Standards in Washington, D. C. It is jointly supported by the American Society for Testing Materials, the Bureau of Standards, the Bureau of Public Roads, and the U. S. Army Corps of Engineers.

QUESTION: What precautions can be taken in reinforced concrete frame construction to prevent the settlement cracks that often form at the top corners of beams immediately above columns?

ANSWER: One worthwhile precaution to prevent this trouble is to interrupt concrete placing operations at the top of the columns before continuing to pour the beam. A delay of an hour to an hour and a half will allow time for the settlement to take place in the column.

QUESTION: Should anti-freeze solutions be removed from engine cooling systems of construction equipment before the onset of hot weather?

ANSWER: Even so-called permanent anti-freeze solutions gradually consume the rust inhibitors which are included by the manufacturers. As the rust inhibitors lose strength, highly corrosive acids are produced. For this reason most experienced construction equipment maintenance men agree that last winter's anti-freeze solution should be removed and discarded.

QUESTION: What effect does salt water have on submerged structures built of concrete?

ANSWER: Tests prove conclusively that when good concrete is submerged in sea water there is a steady gain in compressive strength that continues for many years. In one investigation referred to in a recent issue of the Journal of the American Concrete Institute, 6- by 12-inch cylinders were found after 20 years' exposure in sea water to have attained a strength of 5,305 psi compared with 3,615 psi for cylinders of the same concrete after only one year in the same environment.

QUESTION: How old is the practice of sawing joints in concrete pavements?

ANSWER: A recent issue of Paving Progress, a publication of the Portland Cement Association, states that the earliest sawed joints in the United States are located in California and are 12 years old. The item states

that the joints are in good condition although they are no longer sealed.

QUESTION: In the December 1957 issue of CONCRETE CONSTRUCTION you had a very interesting and informative article titled "Agencies That Attack Concrete." In this article you stated that concrete allowed to age for 28 days in air formed a hardened surface of calcium carbonate due to the combination of calcium hydroxide and carbon dioxide. Did you mean the phrase "in air" literally, i. e., aged for 28 days without moist curing? If so, what would be the surface chemically if the surface were inundated for the 28 days? If not calcium carbonate, would this resultant surface be weaker in tension while still in a moistened condition?

ANSWER: We did not mean to imply that curing in air would replace customary moisture curing. In all cases proper moisture curing is essential for hydration of the cement in air. Although some carbonation may occur when the surface is inundated, the degree achieved is negligible. Generally, carbonation does not take place at 100 percent relative humidity. As the humidity decreases the rate of carbonation increases to a maximum at about 55 percent relative humidity and then decreases to 0 at about 25 percent relative humidity. Concrete cured by inundation is the same chemically as concrete cured by other methods except that in the former case some of the lime may be leached. Concrete which is wet is somewhat weaker than concrete in the dry state, but it is impossible to estimate the difference in strength unless all particulars are known.

QUESTION: Are any figures available on the savings possible in residential construction through the use of grade beams and piers instead of footings and foundations?

ANSWER: We're not familiar with any real study of this problem in comparative costs, but one large scale project builder has claimed that he gets direct savings of 75 to 90 cents a running foot by using grade beams and piers rather than footings and foundations. It should be noted that this type of construction is not acceptable under all codes.

letters to editor

Concrete Construction welcomes informative comment by its readers on any subject pertinent to the broad field it covers. All letters should be addressed Editor, Concrete Construction Magazine, 139 North Clark Street, Chicago 2, Illinois.

Guggenheim Footnote

Sir:

I think your readers might be interested in the following account as a footnote to your recent article on the construction of the Guggenheim Museum (CONCRETE CONSTRUCTION, March 1958, page 10):

On the face of the parapet of the Monitor Building, Mr. Wright had designed a geometric pattern stamped in copper. This is a favored device of his to accentuate the surface of an all concrete structure.

Due to the large size of the parapet, it was obvious that a series of small stampings soldered together and erected on the facade would be required, inasmuch as large stamping machines are not readily available in the area of this project.

On one occasion I requested Mr. Wright to revise his plan of the parapet, so that we would be spared the trouble of providing the large copper stampings. I suggested casting the geometric pattern in the concrete facade and painting the indented surface to make the shadows effective.

With a twinkle in his eye, he said, "That's a good idea—now spray it all with copper."

I dismissed this thought as a joke, but for several days I was bothered by the idea that the great man was not kidding.

Whereupon I went to work and gathered information on metallizing and metallic spraying. This is a fairly common practice in building up worn metals of many types. When I brought a piece of concrete to one of these plants, however, the copper sprayed thereupon promptly crystallized the surface and peeled off.

Then began a series of experiments, which resulted in a successful conclusion as follows:

The panels were precast with concrete about 2½ inches thick, reinforced for handling and temperature. The forms containing the geometric pattern in wood were not oiled, and surfaces were kept clean with soap and water.

The concrete was cast, stripped and carefully cured, and the surface was scrubbed with a detergent (Spic and Span). A very gentle sand was blasted over the surface to be sprayed.

A metallizing gun was used to first spray a thin layer of lead, then a thin layer of zinc, and finally a coat of copper.

The precast panels were then erected upon wood centering and anchored into place by pouring the structure against it. Touching up or final spraying was done in place right up on the scaffold.

Modifications and variations of the procedure may be desired—depending upon the nature of the aggregate, the care in handling the panels, and the type of surface texture required. For example, the first two coats could be combined to effectuate a low temperature bond under proper conditions.

The results are good. The copper coating becomes oxidized and a very natural bronze tinting is obtained with a beautiful patina and without solder lines.

GEORGE N. COHEN
President
Euclid Contracting Co.
New York, N. Y.

New Curing Agents

Sir:

We find every issue of CONCRETE CONSTRUCTION magazine of interest and value, but want to particularly commend you for the excellent article in the June issue entitled "Curing Methods and Materials."

As producers of specialized flooring aggregates and materials, we recognize the great importance of adequate curing to a good and serviceable installation. As a matter of fact, on the few occasions when we hear of poor results with Emeri-Crete Flooring, the cause can most often be traced to ineffectual curing.

We were somewhat disappointed, of course, to discover that no mention

letters

was made of one of the newest types of chemical curing agents, namely the sodium silicate variety, such as our own Emeri-Crete Kure. Ours, incidentally, is to the best of our knowledge the only one of these which has a non-acid penetrant.

However, speaking generically, a sodium silicate curing agent has some important differences or attributes, which we feel might be worthy of special notice. Probably most important among these is the fact that they are a combination curing agent and liquid hardener, converting the "free lime" in portland cement to calcium silicate. Containing no resin, paraffin or wax, they do not clog spraying equipment, and one coat is sufficient for both curing and hardening. Coverage is 500 square feet per gallon, which gives an applied cost equal to or less than most membrane compounds, even though the price per gallon is somewhat higher.

Incidentally, we wish that other publications would adopt your method of perforating the pages of their magazines, permitting the easy and undamaging removal of pages.

G. H. HENNEGAR
Vice President
Walter Maguire Company, Inc.
New York, N. Y.

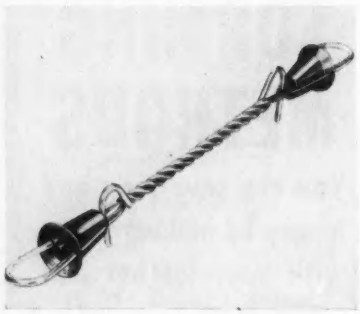
company heads see better profits ahead

If the prophets of doom have you somewhat depressed over the outlook for business in general, you should be interested in some of the findings obtained in a new survey by Dun & Bradstreet. The statistical organization fired some searching questions at 109 chief executives of companies that collectively account for $27 billion in total assets and have annual net sales topping $32 billion.

Five-year projections made by these executives show sales up an average of 34.1 percent, invested capital up 27.2 and number of employees up 15 percent. Most of the company presidents who provided information appear to be more optimistic about their own businesses than they are about the economy as a whole.

equipment tools and materials

Additional free information concerning these items may be obtained by mailing the reader service cards located between pages 16 and 17.

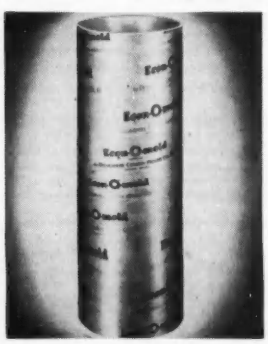


New Form Tie

This break-back form tie incorporates a molded polyethylene cone which is inserted in each end of the tie. It envelopes the tie from the point of break-off, out to the surface of the wall, thus preventing excess bleed at the tie-slot. It can be removed, with practically no spalling, immediately after stripping the forms. **Gates & Sons, Inc., 80 South Galapago Street, Denver 23, Colo.**

Brake Control

A new brake control which provides more sensitive and safe operation of Model 15A Prime-Mover incorporates ball joint linkage rods and positive hand squeeze grip and eliminates cables without increasing the tension required on the hand grip. A single adjusting nut simplifies compensation for brake wear. The manufacturer announces that the new control is one of several improvements designed to insure continuous service. **The Prime-Mover Company, Muscatine, Ia.**

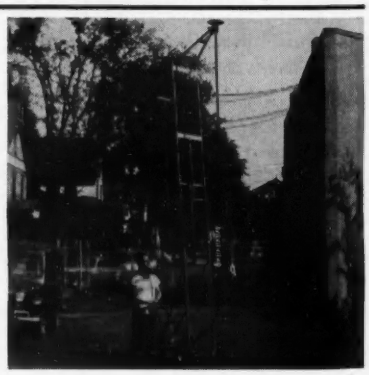


Round Fibre Form

This round concrete column mold is designed for jobs requiring single use or a limited number of columns of any type. It is lightweight, easy to store and saw to fit any size column, requiring fewer men to handle and erect. Made from rigid impregnated fibre, the forms have durable weather waxed coated exteriors and smooth plastic lined interiors. **Deslauriers Column Mould Company, Inc., 5036 West Lake Street, Chicago 44, Ill.**

Ceiling Grinder

Pictured here is a new ceiling grinder which will finish ceilings from 13 to 16 feet high. The grinder has a double telescopic arrangement, making it simple to adjust to the exact height desired. Contractors can finish up to 500 square feet an hour according to the manufacturer. The problem of providing scaffolding for hand grinding is eliminated. **Stow Manufacturing Company, 354 Shear Street, Binghamton, N.Y.**



equipment tools materials

Additional free information concerning any item described in these columns may be obtained by filling out and mailing the postage-free reader service cards located between pages 16 and 17 in this issue.

Epoxy Coating

An architectural finish based on epoxy resins offering superior adhesion, hardness and abrasion resistance is now available in a two-component system for use on masonry construction of all types. The coating can be sprayed, brushed or roller coated. According to the manufacturer this coating is resistance to acids, alkali and solvents; is non-chalking and weather durable. Available in twenty-four decorative colors. Write **Hauger-Beegle Associates, Inc., 900 West 49th Place, Chicago 9, Ill.**

Masonry Cleaner Compound

Morgen Cleaner, a chemical compound that removes mortar and concrete from masonry without harm to skin or equipment is said to be equally effective for removing hardened concrete and mortar from tools, forms, hardware, cranes, buckets, conveyors and concrete mixers. In addition to being safe to use, it is said to be more effective than muriatic acid and to produce no discoloration of masonry. It requires no special equipment to apply. Regular application brushes and ordinary iron pails may be used without fear of damage. Write **Morgen Manufacturing Company, Yankton, S. D.**

Repair Material

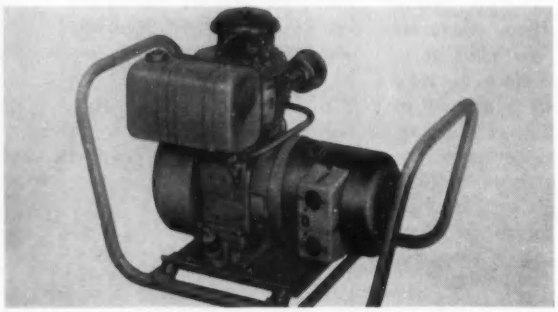
Driveways, roadways, parking areas and indoor traffic lanes which are impractical to close off for permanent resurfacing can be easily and quickly repaired with a new patching compound, Morpro Tamp-Patch, the manufacturer states. The ready-mixed product is said to resist severe weather. The repaired surface can be opened to traffic immediately. No extra aggregates are required. Damaged areas should be coated first with Morpro Tamp-Patch Primer and then Tamp-Patch should be poured dry into the hole and tamped down firmly. Write **Moore Maintenance Products, Haddonfield, N. J.**

Power Cart

A new combination fork lift-concrete cart is designed to handle all kinds of materials. As a fork lift, it carries a load of 1,500 pounds. A removable hopper with fingertip control for easy dumping is optional equipment. The cart is highly maneuverable and direction can be reversed by merely rotating the rear drive wheel. Fork lifts are hydraulically powered. Write **American Road Equipment Company, 4201 North 26th Street, Omaha, Nebr.**

equipment tools materials

Additional free information concerning any item described in these columns may be obtained by filling out and mailing the postage-free reader service cards located between pages 16 and 17 in this issue.

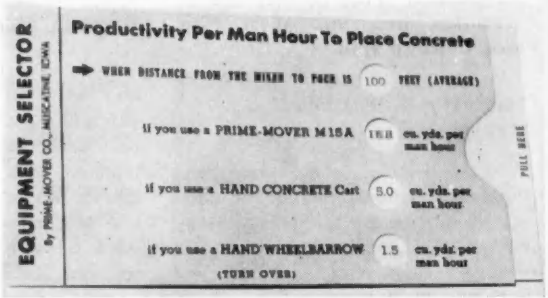


Portable Generator

This direct-coupled, beltless portable electric generator has a capacity of 2.5 kilowatts, supplying 115 volts of direct current. It weighs 165 pounds (dry) and features sealed-for-life bearings and long-life commutators and brushes. It is mounted horizontally on a protective tubular frame which serves as a carrying handle. The 4-cycle, single-cylinder, gasoline engine has a manual rope starter for easy starting. It is air-cooled, and has stellite valves and replaceable seats. **Thor Power Tool Company, Prudential Plaza, Chicago, Illinois.**

Cost Calculator

A free slide-rule-type cost calculator shows how much concrete can be moved per man hour. It also shows the cost per yard to place concrete for various distances and labor rates using each of three methods: wheelbarrows, hand carts, and the Model 15A Prime-Mover. The information is based on average job conditions. It is especially useful to superintendents and construction cost estimators. **The Prime-Mover Company, Muscatine, Ia.**

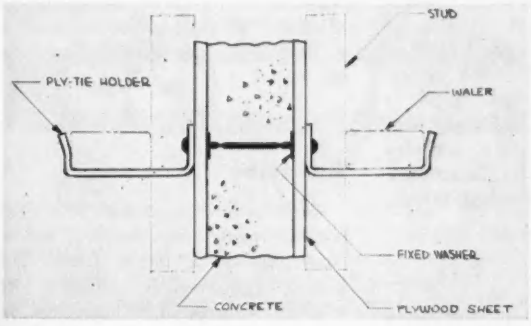


equipment and tools

For more information mail cards facing page 16.

Hoe-Shovel

This all-hydraulic combination hoe-shovel with a capacity of ½ cubic yard mounts on any suitable commercial motor truck. It can be transported at speeds ranging up to 50 mph. The unit is available as hoe only, without basic crane or hoist machinery, or it can be made so as to allow quick field conversion to crane or clamshell work. In the picture, the machine uses a 60-inch shovel dipper to pile excavated material. **Bucyrus-Erie Company, South Milwaukee, Wisc.**



Form Ties

The drawing shows the basic details of a new form tie which, according to the manufacturer, makes forming from 20 to 40 percent faster than conventional systems. With Trueform contractors can use standard size fir plywood panels and select stud spacing according to the job. The Ply-Tie holder has a tear-drop slot which fits over the end of the special form tie. Holder also secures waler in place. Studs are tacked to the plywood panel with one stud backing up each joint. **Trueforms, Inc., 414 Times Square Building, Seattle 1, Washington.**

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Additional free information concerning these items may be obtained by mailing the reader service cards located between pages 16 and 17.

Masonry Kit

Patch-Crete Powder, Patch-Crete Liquid and a trowel are packaged together in a kit and may be mixed in any quantity needed for patching swimming pools, concrete floors or patios. No water is used. According to the manufacturer the product sticks like glue to wood, brick, stone, cement, cinderblock and masonry and is stronger than the old concrete it is replacing. It may be used indoors or outdoors and eliminates chipping, priming, and curing. It sets in fifteen minutes, may be walked on in two hours and driven over in four hours. Write **Camp Chemical Company, Inc., Second Avenue and 13th Street, Brooklyn 15, N. Y.**

Rubber Fabric Bucket

Reinforced molded rubber fabric is used in a new heavy duty 18-quart bucket with lip for easy pouring. The manufacturer states that it is practically indestructible, resisting acid, lime plaster and paints, and is leak-proof, mold-proof and rust-proof. It is graduated for measuring. Buckets nest for easy storing. They are made with a heavier top rim and rounded corner. No plastic or galvanized metal is used in manufacturing this firm's line of rubber buckets, which includes several other sizes. Write **Cauchotex Industries, Inc., 44 Whitehall Street, New York 4, N. Y.**

Patching Mortar and Grout

Two types of Embeco are now available in ready-to-use form. Selecting, assembling, proportioning and weighing of ingredients are thus eliminated. Embeco pre-mixed grout is used for grouting machinery, equipment, anchor bolts, building columns, steel columns, bearing plates, and bridge seats. For patching horizontal and vertical concrete surfaces, caulking seam between floor slab and well, grouting around pipes through walls, caulking pipe joints, and repairing joints of brick and tile floors, Embeco premixed mortar is selected. These fast-setting products do not shrink upon hardening, and produce high compressive and impact-resistant strength, according to the manufacturer. Write **The Master Builders Company, 7016 Euclid Avenue, Cleveland 3, Ohio.**

Alloy Steel Reinforcing Bars

In constructing the new, 23-story Borg-Warner building in Chicago, 1⅝ and 2⅜-inch diameter reinforcing bars of alloy steel were used rather than the usual ones of low carbon steel and smaller diameter. The higher initial cost was largely offset by the savings in size of supporting columns made possible by this type of reinforcing bar. Additional rentable floor space will produce further savings. The bars were furnished in 30-foot lengths, flat at one end and V-shaped at the other. Joints were welded instead of being lapped and tied, making continuous reinforcement throughout the columns. Write **Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.**

Adhesive

Wilhold Builder's Adhesive is a fast-setting, strong, nonshrinking mortar, consisting of a liquid binder and powdered hardener. Job-mixed to form a sticky waterproof mortar, thin for close fits or heavy body for deep furring, it is said to secure, true and plumb in one operation and eliminate the use of other anchors or shims. The manufacturer recommends it for bonding wood, ceramic tile and ornamental material to concrete, brick, stone or plaster in setting metal threshholds, window frames and so forth in masonry buildings. Write **Wilhold Products Company, 678 Clover Street, Los Angeles 31, Calif.**

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Joints. Information on the design, construction and maintenance of expansion, contraction and construction joints in concrete structures is provided in a 24-page booklet, 7-D. A general discussion of joints and their uses is followed by descriptions of joint materials, specific design recommendations and step-by-step construction procedures. A final section is devoted to maintenance. Servicised Products Corporation, 6051 West 65th Street, Chicago 38, Ill.

Fly ash. What fly ash is and how it works to improve concrete mixes for all purposes is explained in a folder, AIA file 3-B-2. A list of projects where it has been used with the architectural firms for each is given and several pictures are included. For contractors this is a concise, informative folder. Chicago Fly Ash Company, 228 North LaSalle Street, Chicago 1, Ill.

Forming equipment. Step-by-step illustrations in booklet No. 1026 show Simplex Forms being used to form foundations walls in a floating slab home construction project. The manufacturer states that less than 24 man-hours were required for completing the foundation with footings. Panels weigh only 35 pounds each, and are easily carried or moved by truck to the next job. Locking hardware is mounted on the forms, saving pick-up operations and lost hardware. A minimum of bracing is required. Accessories are available for handling variances in foundation plans. Simplex Forms System, Inc., 2500 North Main Street, Rockford, Illinois.

Scaffolding. Special features of Advance tubular steel scaffold according to the manufacturer are the unique self-contained panel and brace locking devices which permit speedy assembly of all scaffold and accessories without tools. Folder 62 shows how to assemble the scaffolding and illustrates with clear diagrams in chart form all the various types available. Beaver-Advance Corporation, Ellwood City, Pa.

Wire rope storage. "Storage and Lubrication of Wire Rope" is the title of bulletin No. 103 which presents proper procedures to follow when either new or used wire rope is to be stored, as well as the steps to take when the rope is put back into service. Lubricating methods are included. Leschen Wire Rope Division, H. K. Porter Company, Inc., 2727 Hamilton Avenue, St. Louis 12, Missouri.

Form ties. A 6-page folder on Williams Form ties for use with Symons forms gives specifications and prices. Many other accessories needed in forming are also listed. Symons Clamp & Manufacturing Company, 4249 Diversey Avenue, Chicago 39, Illinois.

Polyethylene film. A folder pictures polyethylene film in use in construction as well as in other fields. This manufacturer's product is available in 2-, 4- and 6-mil clear and in 6-mil sun resistant black. Folder 4-C-2, Glas-Kraft, Inc., Mill Street, Lonsdale, Rhode Island.

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Latex binder. Two types of Surco Latex Binder are described in bulletin 3-B-2. The material is a modified latex emulsion which imparts to cementitious materials excellent tensile strength, density, watertightness, resilience, resistance to wear and temperature changes and protection against certain corrosive agents. It is suitable for original surface coating of utility floors, waterproofing above or below grade, roof coating and surface finishing for structural concrete of all shapes and functions. Surco International Corporation, 1330 West Peachtree Street, N. W., Atlanta 9, Georgia.

Calcium chloride. This booklet outlines and illustrates ten uses for calcium chloride, several of which are of special interest to the concrete contractor. Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania.

Admixture. Trimix is a multi-purpose liquid admixture designed to speed and improve quality of concrete construction at freezing temperatures. A brochure, AIA File No. 3-B-2, includes product specifications and data on application as well as an illustrated chart showing how Trimix makes winter concreting safer by accelerating setting time, improving workability of the mix, reducing concrete shrinkage, reducing the period during which artificial heat or covering is required, and helping to resist bleeding and segregation. Building Products Division, L. Sonneborn Sons, Inc., 404 Fourth Avenue, New York 16, New York.

Construction products. An 8-page booklet lists more than 50 products for all phases of the construction industry. It is divided for easy reference into type of specification and use areas and offers data on adhesives, pressure-sensitive tapes, reflective materials for signs and markings, non-slip surfacing sealers, insulative and protective coatings, electrical connectors and splice systems. Minnesota Mining and Manufacturing Company, 900 Bush Street, St. Paul 6, Minnesota.

Handling equipment selector. This little selector works like a slide rule to give productivity per man hour to place concrete when using a Prime-Mover, hand concrete cart or hand wheelbarrow, and the costs involved with the same three types of equipment. Prime-Mover Company, Muscatine, Iowa.

Power trowel. Bulletin K-103 gives specifications on various models of the Kelley Hydra-Trowel. Details concerning this hydraulic trowel in use are furnished, and many excellent features described. The manufacturer offers a demonstration of the trowel in use. Kelley Machine Division, Wiesner-Rapp Company, Inc., 285 Hinman Avenue, Buffalo 23, New York.

Concrete cutting blades. Diamond, break-resistant and abrasive blades are covered in brochure No. 3006, including small diameter blades for use on all power hand saws. A list of the manufacturer's branches is also included, offering immediate shipment to all parts of the country. Clipper Manufacturing Company, 2800 Warwick, Kansas City 8, Missouri.

book reviews

American Concrete Institute Concrete Primer. *Published by American Concrete Institute, P. O. Box 4754, Redford Station, Detroit 19, Michigan. 72 pp. $1.00.*

A new edition of this pocket sized, question and answer Primer develops in simple, concise terms the principles influencing concrete mixtures, and shows how a knowledge of these principles can be applied to the production of permanent structures in concrete.

Over the past quarter century there have been vast improvements in the machinery and devices for the preparation of materials, accurate proportioning of ingredients, and the transportation, consolidation, and protection of concrete. With the exception of the addition of controlled amounts of entrained air, the fundamentals of making durable concrete have remained unaltered. The comprehensive additions to the Concrete Primer are those which take into account the concept of air entrainment, the recognition of reactive aggregates, the use of several cement types, and high-frequency vibration in the placing of fresh concrete. The progress of technology is reflected in the expanded section on mixing time, covering transit mixing and new mixer designs. Questions and answers regarding soniscope, rebound, and indentation tests have been added.

Proceedings of the Second Congress of the Fédération Internationale de la Précontrainte, Amsterdam 1955. *Published by the Fédération Internationale de la Précontrainte, Terminal House, Grosvenor Gardens, London, S. W. I. 900 pp. $15.00.*

This volume contains all the papers, general reports, and communications presented at the Congress and all the contributions to the discussions. Each of the papers and contributions is printed in the language — English, French, or German—in which it was written or spoken. The general reports and communications are in all three languages. A list of the main themes of the Congress is printed at the end of the book. Engineers from thirty different countries attended the Congress and these Proceedings indicate the great advances made in the techniques and applications of prestressing since the first Congress in 1953. They should be of value to all interested in modern construction and design.

Composite Construction in Steel and Concrete: For Bridges and Buildings. *By Ivan M. Viest, R. S. Fountain, and R. C. Singleton. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, N. Y. 1958. 192 pp. Illus. $7.50.*

Here is an engineering manual on the design of steel beams and concrete slabs for composite construction, showing the advantages of the method and fully covering design procedures and practical applications. The basis of composite construction and its advantages, design equations and procedures, and methods of connecting slabs to beams are discussed and illustrated. A rapid method for the composite design of beams, developed especially for this book, is explained in detail and illustrated by six complete examples. The book presents design methods for the three most commonly used shear connectors: studs, flexible channels, and spirals. The methods and examples follow the provisions of the 1957 specifications for composite design for highway bridges. In view of the growing use of composite construction for buildings, the book provides information in this field in a separate appendix.

Building Construction Handbook. *Edited by Frederick S. Merritt. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, N. Y. 1958. Illus. $15.00.*

Whether your interest in building is practical and direct, as an engineer or construction man, or whether you are a management man responsible for getting a building built economically, this handbook will give you the overall insight necessary to understand and follow through with the details of every step. The book emphasizes answers to problems of how and why in design and construction. It deals with such matters as the taking of bids

and letting of contracts, methods of correcting defective concrete work, suggestions for reducing steel construction costs, and means of getting the most value out of cost estimates and surveys for buildings. All stages of construction and construction management are covered, including information on such aspects as building materials, stresses in structures, soil mechanics and foundations, concrete, timber and steel construction, acoustics, insulation, heating and air conditioning, plumbing, estimating costs, and specifications.

Design of Concrete Structures. *Sixth Edition. By Leonard Church Urquhart, Charles Edward O'Rourke and George Winter. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, N. Y. 546 pp. Illus. $8.00.*

This edition, like its predecessors, gives a sufficient development of the theory of concrete design to insure the beginner a thorough understanding of the fundamentals. With the exception of some highly specialized structures, the entire field of reinforced concrete design is covered. Complete designs of some of the more common structures are given and emphasis is placed on a thorough discussion of basic structural performance, fundamental mechanics, and physical explanation.

The changes introduced in the 1956 revision of the American Concrete Institute's Building Code are reflected in this sixth edition. The admission of ultimate-strength design as a permissible, optional alternate to conventional design procedures, probably the most drastic change, is discussed. Other major changes of the Code which are reflected in the book include an almost completely revised and simplified method of designing eccentrically loaded columns, a more cautious and partly new method of design for diagonal tension, extensive revisions in the calculation of flat slabs, and several other important changes.

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